63545

Basaltic Impact Melt

16 grams

Figure 1: Photo of 63545 after early allocation. Scale in cm/mm. S72-55402.

Introduction

63545 was collected as a rake sample from station 13, Apollo 16 (figure 2). It is a coherent impact melt rock with numerous zap pits (figure 1). It has been dated at 3.9 b.y. and is the type example of VHA basalt (Hubbard et al. 1973; Irving 1975).

Petrography

63545 is a subophitic impact melt rock with a few relict clasts (figure 3). It is a fine-grained, impact melt rock made up of pink spinel, plagioclase, olivine, pyroxene, ilmenite and metal (with residual interstitial glass). It has clasts of mostly plagioclase (unstudied).

The major element composition plots within the spinel liquidus field on the low-pressure pseudoternary Walker diagram. 63545 has pleonaste spinel as its liquidus phase at the pressure interval 0 to 30 kbars (Delano 1977).

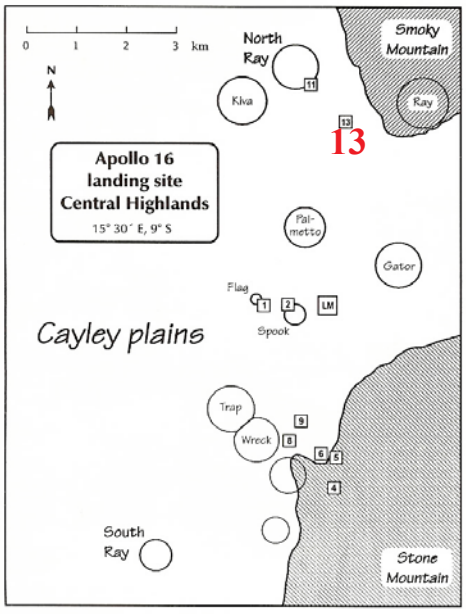


Figure 2: Map of A16 site with station 13 shown (from Korotev 1994).

Figure 3: Photomicrographs of thin section 63545,6 by Delano (1977). Field of view is 0.5 mm. Note the apparent relict clast in lower view.

Mineralogy

The mineralogical mode and composition of minerals in 63545 have not been reported (Ryder and Norman 1980). Several investigators have reported pink spinel, but give no details.

Chemistry

Hubbard et al. (1973) published analysis of 63545 and grouped it in their VHA basalt type. Stoffler et al. (1985) determined the composition by broad beam electron probe analyses. Korotev (1994) apparently chemically grouped 63545 with other samples termed "2NR". However, it has the lowest Sc and Sm of this group (figure 4) and is petrographically distinct. The critical siderophile element content has not been determined.

Radiogenic age dating

Norman et al. (2006) dated 63545 at 3.84 b.y. by Ar 39-40.(figures 5 a,b). Nyquist et al. (2011) determined 3.91 b.y. by Sm-Nd and 3.84 b.y, by Rb-Sr internal mineral isochrones (figures 6 a,b). Figure 7 is a summary of Apollo 16 ages by Ar/Ar (Norman et al. 2006).

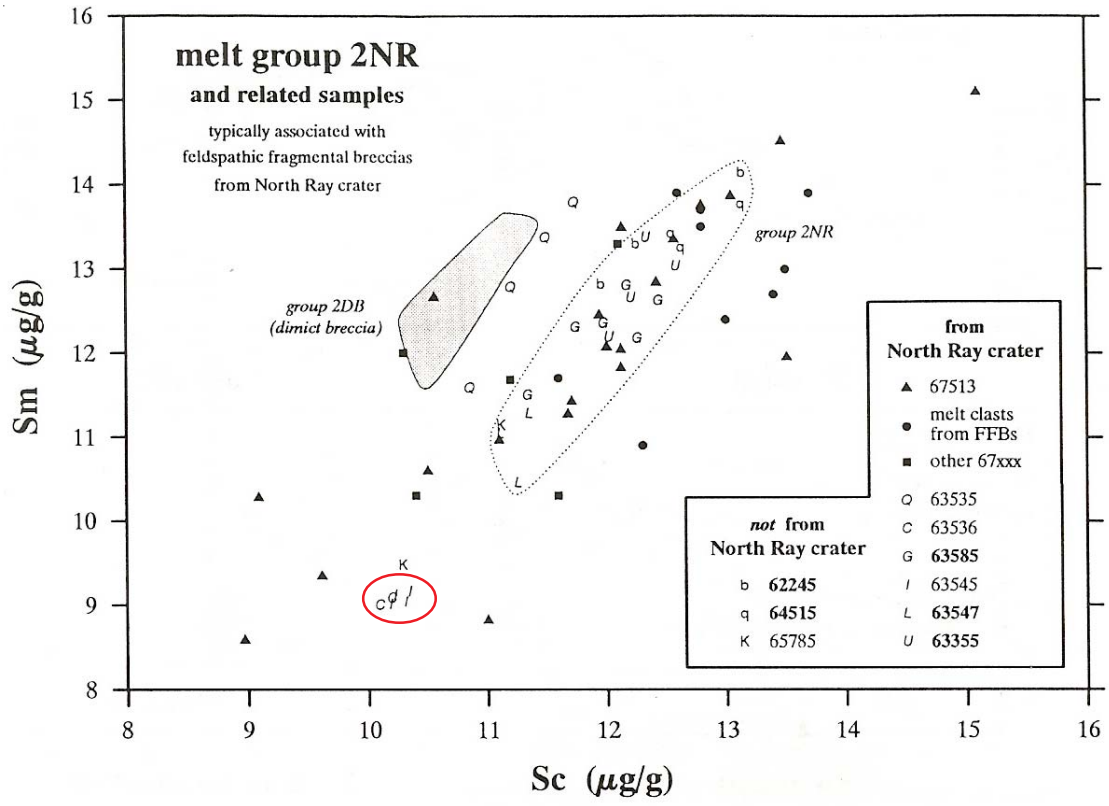


Figure 4: Composition of 63545 on Randy Korotev's main diagram for Apollo 16.

Table 1. Chemical composition of 63545.

reference	Hubbard73		Stoffler85		*2NR Korotev94*	
weight					*group*	
SiO2 %	43.36		(a) 43.7	(d)	*45.3*	(c)
TiO2	0.96	0.96	(a) 1.11	(d)	*1*	(c)
Al2O3	22.4	22.04	(a) 24.4	(d)	*21.2*	(c)
FeO	7.21	6.32	(a) 4.9	(d)	*7.7*	(c)
MnO	0.07		(a) 0.06	(d)	*0.09*	(c)
MgO	12.31	12.3	(a) 11	(d)	*11.1*	(c)
CaO	12.8	13.3	(a) 14	(d)	*12.9*	(c)
Na2O	0.38	0.38	(a) 0.43	(d)	*0.5*	(c)
K2O	0.12	0.124	(a) 0.11	(d)	*0.3*	(c)
P2O5	0.17		(a) 0.08	(d)	*0.19*	(c)
S %	0.08		(a)		*0.11*	(c)
sum						
Sc ppm					*12.2*	(c)
V						
Cr		750	(b)		*1190*	(c)
Co					*44.1*	(c)
Ni					*650*	(c)
Cu						
Zn						
Ga						
Ge ppb						
As						
Se						
Rb		3.16	(b)		*6*	(c)
Sr		170	(b)		*166*	(c)
Y						
Zr					*400*	(c)
Nb						
Mo						
Ru						
Rh						
Pd ppb						
Ag ppb						
Cd ppb						
In ppb						
Sn ppb						
Sb ppb						
Te ppb						
Cs ppm					*0.22*	(c)
Ba		204	(b)		*277*	(c)
La		19.7	(b)		*27.6*	(c)
Ce		47.9	(b)		*72*	(c)
Pr						
Nd		32.2	(b)		*43*	(c)
Sm		8.55	(b)		*12.7*	(c)
Eu		1.48	(b)		*1.51*	(c)
Gd		10.1	(b)			
Tb					*2.52*	(c)
Dy		11.2	(b)			
Ho						
Er		6.47	(b)			
Tm						
Yb		5.94	(b)		*8.85*	(c)
Lu		0.888	(b)		*1.2*	(c)
Hf					*9.6*	(c)
Ta					*1.11*	(c)
W ppb						
Re ppb						
Os ppb						
Ir ppb					*15.9*	(c)
Pt ppb						
Au ppb					*13.4*	(c)
Th ppm					*4.4*	(c)
U ppm		0.699	(b)		*1.26*	(c)

technique: (a) XRF, (b) IDMS, (c) NOT a real analysis

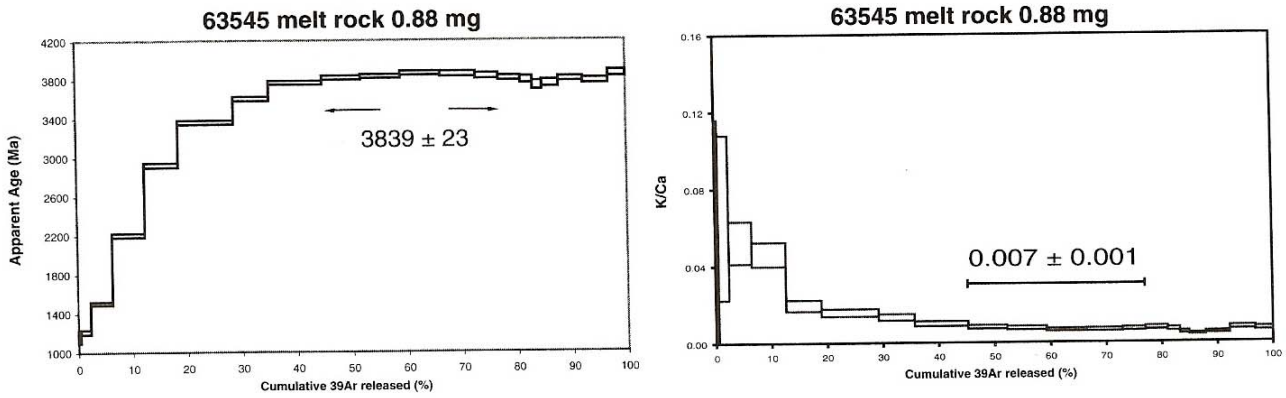


Figure 5a, b: Argon 39/40 age of 63545 (Norman et al. 2006).

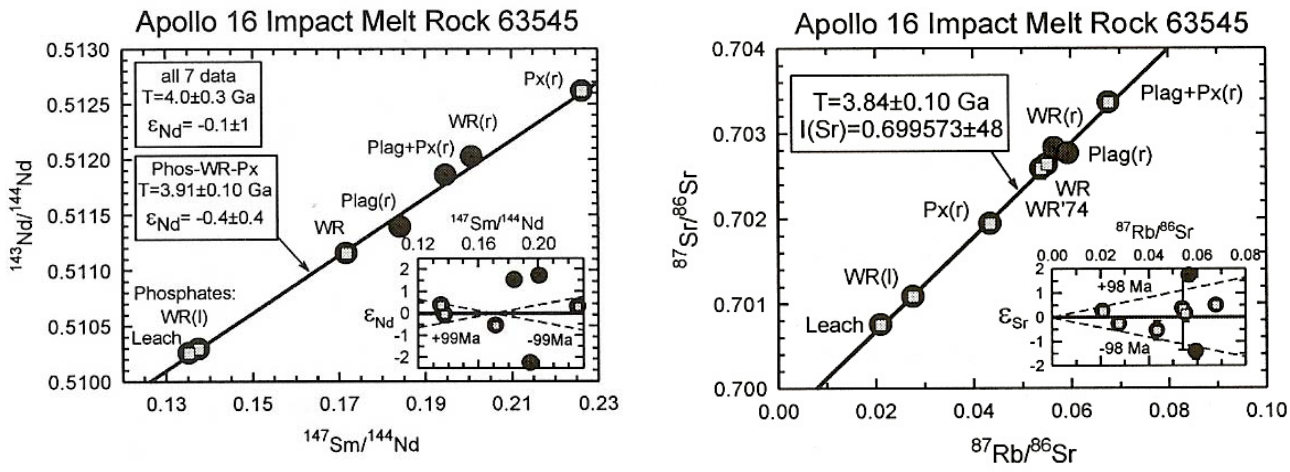


Figure 6 a,b: Internal mineral isochrons for 63545 (Nyquist et al. 2011).

Other Studies

Pearce and Simonds (1974) reported some magnetic measurements made on a potted butt.

Processing

63545 has been chipped, not sawn. There are 3 thin sections.

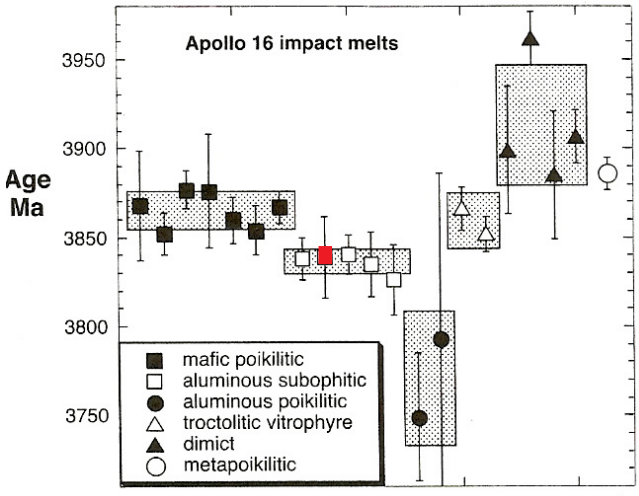
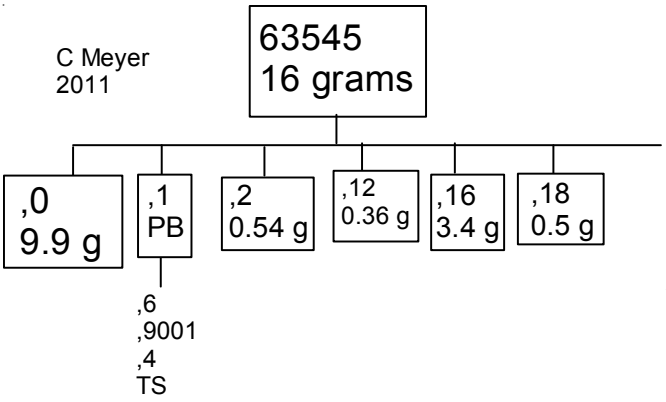


Figure 7: Summary age diagram by Norman et al.2006, based on their Ar/Ar dating.

Summary of Age Data for 63545

	Ar/Ar	Rb/Sr	Sm/Nd
Norman et al. 2006	3.84 ± 0.02 b.y.		
Nyquist et al. 2011		3.84 ± 0.1 b.y.	3.91 ± 0.1 b.y.

Caution: Not corrected for various versions of decay constants.



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